

WHAT IS CLAIMED IS:

1. A process for preparing normal alpha olefins having at least six carbon atoms which comprises the steps of:
 - a) dehydrogenating a hydrocarbon mixture comprising a major amount of linear paraffinic compounds containing at least ten carbon atoms under dehydrogenating reaction conditions controlled to produce a conversion of said linear paraffinic compounds to internal olefins no greater than 50 wt.% thereby minimizing the amount of dienes produced; and
 - b) contacting said internal olefins with ethylene under ethenolysis reaction conditions thereby producing a reaction product mixture comprising a substantial amount of normal alpha olefins having at least six carbon atoms.
2. The process according to Claim 1 wherein said hydrocarbon mixture comprises at least about 70 wt.% linear paraffinic compounds having at least ten carbon atoms.
3. The process according to Claim 1 wherein said hydrocarbon mixture comprises at least about 90 wt.% linear paraffinic compounds having at least ten carbon atoms.
4. The process according to Claim 1 wherein a normal alpha olefin fraction having a boiling point less than the boiling point of the paraffinic fraction of said hydrocarbon mixture is recovered from the reaction product mixture of step (b) of Claim 1 by distillation.

5. The process according to Claim 1 wherein said hydrocarbon mixture has been prepared by Fischer-Tropsch type process.
6. The process according to Claim 1 wherein said hydrocarbon mixture has been
5 purified by extraction or adsorption prior to the dehydrogenation to remove organic sulfur compounds.
7. The process according to Claim 1 wherein said hydrocarbon mixture has been
10 hydrogenated prior to dehydrogenation to convert oxygenates and olefins to paraffins and organic sulfur compounds to hydrogen sulfide and wherein said hydrogen sulfide has been separated from said hydrocarbon mixture prior to dehydrogenation.
8. The process according to Claim 1 wherein the diene content of the internal olefin
15 feed to step b) is reduced to less than about 1 wt.%.
9. The process according to Claim 8 wherein said reduction is effected by selective diene hydrogenation.
- 20 10. The process according to Claim 8 wherein said reduction is effected by selective diene adsorption.
11. The process according to Claim 1 wherein conjugated dienes are removed from
25 the internal olefin feed to step b) by reacting said conjugated dienes with a physically separable dienophile to produce an adduct of the conjugated diene and the dienophile and separating said adduct and unreacted dienophile from said internal olefin feed.

12. The process of Claim 11 wherein said dienophile is maleic anhydride.
13. The process of Claim 12 wherein said maleic anhydride is dispersed on an inorganic support and said adduct deposits out on said support.
- 5 14. The process of Claim 12 wherein said reaction is conducted as a liquid:liquid reaction using molten maleic anhydride as one immiscible liquid phase and said internal olefin phase as the other and wherein said molten maleic anhydride together with the adduct are separated from said internal olefin phase.
- 10 15. The process according to Claim 12 wherein said reaction is conducted as a liquid:liquid phase reaction using said internal olefin feed as one phase and maleic anhydride dissolved in an immiscible inert organic solvent as the other phase and wherein following reaction the resulting adduct and excess maleic anhydride are removed with the immiscible solvent from said internal olefin liquid phase.
- 15 16. The process of Claim 8 wherein following reduction of the diene content to below 1 wt.%, conjugated dienes are reduced to below 100 ppm by reaction with a physically separable dienophile to produce an adduct and separating said adduct and unreacted dienophile from said internal olefin feed.
- 20 17. The process of Claim 16 wherein said dienophile is maleic anhydride.
- 25 18. The process of Claim 17 wherein said maleic anhydride is dispersed on an inorganic support and said adduct deposits out on said support.

19. The process of Claim 17 wherein said reaction is conducted as a liquid:liquid reaction using molten maleic anhydride as one immiscible liquid phase and said internal olefin phase as the other and wherein said molten maleic anhydride together with the adduct are separated from said internal olefin phase.
- 5 20. The process according to Claim 17 wherein said reaction is conducted as a liquid:liquid phase reaction using said internal olefin feed as one phase and maleic anhydride dissolved in an immiscible inert organic solvent as the other phase and wherein following reaction resulting adduct, excess maleic anhydride are removed with the immiscible solvent from said internal olefin phase.
- 10 21. The process according to Claim 1 wherein the normal alpha olefins are separated from the ethenolysis reaction product and the remaining paraffins and internal olefins are recycled to the dehydrogenation step.
- 15 22. The process according to Claim 6 wherein normal alpha olefins are separated from the ethenolysis reaction product and remaining paraffins and internal olefins are recycled to the purification step preceding the dehydrogenation step.
- 20 23. The process of Claim 1 wherein a normal alpha olefin product is recovered from said reaction product mixture have an average molecular carbon atom number within about 25 carbon atoms of the linear paraffinic fraction of said hydrocarbon fraction.
- 25 24. The process of Claim 1 wherein said dehydrogenation is conducted at temperatures in the range of about from 500°F to 900°F, pressures in the range of about from 0.5 to 3 atms, and liquid hourly space velocity in the range of about from 1 to 50 hr⁻¹.

25. The process of Claim 1 wherein said dehydrogenation is conducted in the presence of a catalyst comprising at least one metal selected from the group of Group VIII noble metal.
- 5 26. The process of Claim 1 wherein said ethenolysis is conducted at temperatures in the range of about from 50°F to 600°F, pressures in the range of about from 1 to 15 atms and space velocities in the range of about from 0.1 to 10 hr⁻¹.
- 10 27. The process of Claim 1 wherein said ethenolysis is conducted in the presence of a catalyst comprising ruthenium at temperatures in the range of about from 60°F to 80°F, pressures in the range of about from 1.5 to 3 and space velocities in the range of about from 0.2 to 2 hr⁻¹.
- 15 28. The process of Claim 1 wherein said ethenolysis is conducted at temperatures in the presence of a catalyst comprising tungsten in the range of about from 400°F to 600°F, pressures in the range of about from 8 to 12 atms and space velocities in the range of about from 0.2 to 2 hr⁻¹.
- 20 29. A process for upgrading a Fischer-Tropsch type reaction product containing at least 70 wt.% C₁₆-C₁₀₀ linear paraffinic compounds, into lower boiling NAOs which comprises the steps of:
- 25 a) dehydrogenating said Fischer-Tropsch reaction product to produce C₁₆-C₁₀₀ linear internal olefins under dehydrogenating conditions adjusted to produce a conversion based on said linear paraffinic compounds of about from 15 to 50 wt.%.

- b) contacting said C₁₆-C₅₀ linear internal olefins with ethylene in the presence of an ethenolysis catalyst under reactive conditions thereby producing a reaction product comprising a substantial amount of lower boiling NAOs.

5 30. The process of Claim 29 wherein Fischer-Tropsch type reaction product is a Fischer-Tropsch reaction product.

31. The process of Claim 29 wherein said Fischer-Tropsch type reaction product is a Kobbel-Englehardt reaction product.

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32. An integrated ethenolysis and hydrotreating or hydroisomerization process for upgrading Fischer-Tropsch type hydrocarbon reaction products containing at least about 20 wt.% C₁₆-C₅₀ linear paraffinic compounds into C₆-C₂₄ NAOs and at least one liquid fuel or base oil which comprises the steps of:

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- a) fractionating said Fischer-Tropsch type product to produce a wax fraction comprising at least 70 wt.% linear C₁₆-C₅₀ linear paraffinic compounds and at least one other fraction boiling at a temperature range different than said wax fraction;

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- b) dehydrogenating the wax fraction of step (a) to produce C₁₆-C₅₀ linear internal olefins and wherein said dehydrogenation is conducted at a conversion no greater than 50 wt.% based on said wax fraction;

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- c) contacting said C₁₆-C₅₀ linear internal olefins with ethylene in the presence of an ethenolysis catalyst under reactive condition thereby producing a reaction product comprising a substantial amount of C₆-C₂₄ NAOs; and

- d) hydrotreating or hydroisomerization at least one of said other fractions of step (a) and fractionating the resulting effluent and recovering at least one liquid fuel fraction or at least one lubricating oil fraction.
- 5 33. A process for converting C_1 - C_3 alkane gasses into C_6 and higher NAOs which comprises the steps of:
- a) reforming said C_1 - C_3 alkanes into synthesis gas;
- 10 b) contacting said synthesis gas with a Fischer-Tropsch catalyst under reactive conditions to yield two hydrocarbon product streams, one a wax containing product boiling above a selected value in the range of about 350°F (177°C) to about 700°F (371°C) comprising at least
- 15 20 wt.% C_{10} - C_{50} linear paraffinic compounds, and a second hydrocarbon product boiling below about said value, containing hydrocarbons boiling in the liquid fuel range;
- c) fractionating the wax containing product of step (b) into fractions comprising at least a wax fraction comprising at least 70 wt.% C_{10} - C_{50}
- 20 linear paraffinic compounds, and a heavy fraction boiling above about 1100°F (393°C);
- d) dehydrogenating the wax fraction of step (a) at a conversion, based on said linear paraffinic compounds, no greater than 50 wt.% to produce
- 25 C_{10} - C_{50} linear internal olefins;
- e) contacting said C_{10} - C_{50} linear internal olefins with ethylene in the presence of an ethenolysis catalyst under reactive conditions thereby producing a

reaction product comprising a substantial amount of C_6 and higher NAOs;
and

- 5 f) separating said reaction product of step (e) to recover at least one NAO fraction within the range of C_6 and higher NAOs having a NAO purity of at least 70 wt.%.

34. A process for converting C_1 - C_3 alkanes into C_6 - C_{24} NAOs which comprises the steps of:

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- a) reforming said C_1 - C_3 alkanes into synthesis gas;
- b) contacting said synthesis gas with a Fischer-Tropsch catalyst under reactive conditions to yield a reaction product mixture of hydrocarbons comprising C_{10} - C_{50} paraffinic compounds, vacuum gas oil, middle
15 distillate, gasoline light oxygenates and light olefins;
- c) fractionating the Fischer-Tropsch reaction product mixture of step (b) into separate fractions comprising a wax fraction containing at least
20 70 wt.% linear C_{16} - C_{50} paraffinic compounds at least one liquid fuel fraction and at least one higher boiling fraction boiling above the temperature of the wax fraction;
- d) dehydrogenating the wax fraction of step (c) at a conversion no greater
25 than about 50 wt.%, based on said linear paraffinic compounds, to produce C_{16} - C_{50} linear internal olefins;

- e) contacting said C₁₆-C₅₀ linear internal olefins with ethylene in the presence of an ethenolysis catalyst under reactive conditions thereby producing a reaction product comprising a substantial amount of C₆-C₂₄ NAOs;
- 5 f) fractionating the reaction product of step (e) into at least one NAO fraction within the range of C₆-C₂₄ having a C₆-C₂₄ NAO purity of at least 70 wt.% and a higher boiling fraction containing NAOs having more than 20 carbon atoms and branched olefins and paraffins; and
- 10 g) hydrotreating or hydroisomerizing at least one of the liquid fuel fractions and higher boiling fractions recovered in step (c) and the higher boiling fraction recovered in step (f) to produce a reaction product comprising liquid fuel hydrocarbons.
- 15 35. An NAO mixture made by the process according to Claim 1.